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To "Wood, Thomas" <TRWOOD@stoel.com>
cc Joseph Lapka/R9/USEPA/US@EPA
bcc
Subject Cabrillo Port - one more question

Per my telephone message - one more additional question. Please let me know the timing for BHP providing responses to the questions asked in this email, and my emails of March 14th and 29th.

Also, please let me know if you need any clarification regarding this new question.

Thanks


continuous product delivery.pdf

Question: The application implies that the FSRY will have a continous supply of LNG and therefore will have a continuous supply of BOG on which to operate the main generator engines. However, that fact does not appear to be explicitly stated anywhere in the permit application. Please confirm that under normal operations, the intent is for the FSRY to have a constant supply of BOG.

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No other emission limitations or control technologies were identified. At EPA's request, BHPB evaluated the feasibility of utilizing gas combustion turbines (CTs) instead of ICEs. ICEs were chosen by BHPB because of their higher efficiency, greater reliability and significantly lower CO_2 emissions, as compared to CTs. CTs have a lower NOx concentration, but significantly higher flow rate, resulting in comparable emissions at a set load. ICEs have a thermal efficiency of 47.4% while CTs have a thermal efficiency of 32.5%. NO_X emissions from an ICE controlled with SCR are comparable to a CT with SCR. Therefore, there is no emission advantage to using CTs instead of ICEs. Operating CTs to generate 110,903 MW-hrs/yr (the anticipated worst case load) generates 11 tons per year of NOx, while operating ICEs at the same load generates 13 tons per year of NOx (assuming both are controlled by SCR). By contrast, gas fired turbines generating 110,903 MW-hrs/yr emit approximately 10,000 more tons per year of CO_2 than IC engines at the same load, as well as more PM_{10} and SO_X.

Based upon the emissions being comparable between SCR controlled ICEs and SCR controlled CTs, BHPB relied on other reasons to choose ICEs for the Project. The availability of the power generation driver is important for a facility providing essentially continuous product delivery into a utility distribution system. Statistical reliability data for equipment used in offshore applications is published in the *Offshore Reliability Data Handbook* ("OREDA"). OREDA is prepared in co-operation with the Norwegian Petroleum Directorate and uses data from several major North Sea operators. The OREDA data document that ICE are more reliable than gas turbines (98.55% v. 94.49%). Data gathered domestically by the WorleyParsons engineering firm indicates an even bigger differential in favor of the ICE (92.82% versus 82.92%). Therefore, a key reason to choose ICEs over CTs was reliability and availability.

BHPB also chose ICEs over CTs based on maintenance concerns. It is important that the power generation be maintainable on-board the vessel by the FSRU staff. ICEs are generally maintainable by the onboard engineer. The technology is well known and understood by engineers with a marine background. On the other hand, most maintenance performed on a turbine requires specialized skills, and workshop facilities not appropriate for an FSRU. Apart from routine inspections and minor maintenance activities, turbine maintenance and overhauls must occur onshore in specialized workshops. This requires fly-in/ fly-out change-over of CTs. An ICE typically requires major overhauls after 40,000 operational hours whereas a CT typically requires major hot-end overhauls after only 25,000-30,000 operational hours. Therefore, maintenance concerns also drove the choice of ICEs over CTs.

BHPB evaluated whether the installation of SCR for backup fuel operations would be considered a technically feasible and cost-effective technology. The ICEs have a potentially interruptible gas supply. Therefore, it is necessary to have dual fuel firing capability in the unlikely event there is no gas available. BHPB conducted a Ventura